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HOW ARE CHINA'S STATE-OWNED ENTERPRISES DOING IN THE 1990s?

Evidence From Three Interior Provinces

by

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ABSTRACT:

Since its inception in the early 1980s, the success of China's enterprise reforms remains hotly debated. This paper introduces a new element into the analysis of state-owned enterprise performance by drawing on the recent increase in inter-regional income disparities. It is argued that as a result of less favourable structural conditions and stronger fiscal dependence on the central government, reform implementation in the interior provinces has lagged behind the progress made along the coast. This hypothesis is investigated using enterprise survey data from three interior provinces which is compared to a similar survey carried out earlier in four coastal cities. The evidence generally supports the view of larger administrative restrictions in the interior and relatively poor economic performance.

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I. INTRODUCTION:*

The performance of China's state-owned enterprises (SOEs) has been hotly debated ever since the inception of industrial reforms almost 15 years ago. Until the late 1980s, a widely shared view held that the partial nature of China's enterprise reforms had limited their effectiveness. Efficiency was declining and the soft budget constraint was still largely in existence (see e.g. Tidrick, 1986; Wong, 1986). More recently, those finding were contested in a series of enquiries starting with Chen et al. (1988) which revealed substantial efficiency improvements in China's SOEs over the 1980s (Jefferson, Rawski and Zheng, 1992; Groves et al, 1994; for surveys of that literature see Wu, 1993; Raiser, forthcoming). However, this optimistic assessment has not remained unchallenged either, as China's SOEs have produced growing losses and arguably have become a financial burden for the rest of the economy (Woo et al., 1994; Broadman, 1995; Bouin, 1996). The optimists counter that SOEs overstate losses in order to evade taxation and that declining profits are a result of growing competition on the domestic market and are not necessarily a general concern, albeit an urgent fiscal problem (Sicular, 1994; Jefferson and Rawski, 1994).

As it stands, the debate is far from its resolution. One reason for this may be that the discussion tends to generalise results obtained from enterprise survey data which may or may not be representative for the whole industrial sector.[1] Specifi-

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1 Jefferson, Rawski and Zheng (1992) estimate total factor productivity growth in SOEs based on aggregate data, but their production elasticities are derived from a cross-section of enterprises.

cally, the regional and sectoral dimensions of SOEs performance are often left unexplored. However, one of the salient features of the Chinese economy since the mid-1980s is precisely the growing income gap between the Southeastern coastal provinces and the rest of China (Jian, Sachs and Warner, 1996; Raiser, 1996). Part of this divergent performance might be attributed to variations in the implementation of enterprise reforms at the local government level which effectively control around 80 per cent of all SOEs. Another reason, not incompatible with the foregoing, is that growing competition in the 1990s has indeed exposed SOE inefficiencies. The resulting losses would be expected to be larger in the interior regions where reforms had progressed less during the 1980s.

This paper tries to fill parts of these gaps by offering new enterprise level evidence from three interior provinces for the 1990-1994 period. The data come from an enterprise questionnaire distributed to 372 state-owned, collective, township and private enterprises in Jilin, Shanxi and Sichuan provinces. The same questionnaire was also employed in an earlier survey among enterprises located in four of China's most dynamic coastal areas, namely Guangzhou, Shenzhen, Xiamen and Shanghai (Raiser, forthcoming). This allows for some comparisons of the qualitative data in particular to test for regional differences in the implementation of reforms.[2] As I will show, major differences in SOE autonomy exist in the labour market, with a vast majority of the interior sample reporting administrative interference in employment and to a lesser extent wage decisions, whereas such interference is only reported by a minority of SOEs in the coastal sample. The interior sample also shows a much greater sensitivity to competition, product quality, information on suppliers and markets, and availability of skilled workers as determinants of performance, arguably reflecting the greater structural difficulties in the old industrial heartland of China. The greater autonomy of township and private enterprises that has been established in previous studies is

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2 A quantitative comparison is in principle possible by pooling data from the two surveys for the years 1990-1992. This must be left open for future research.

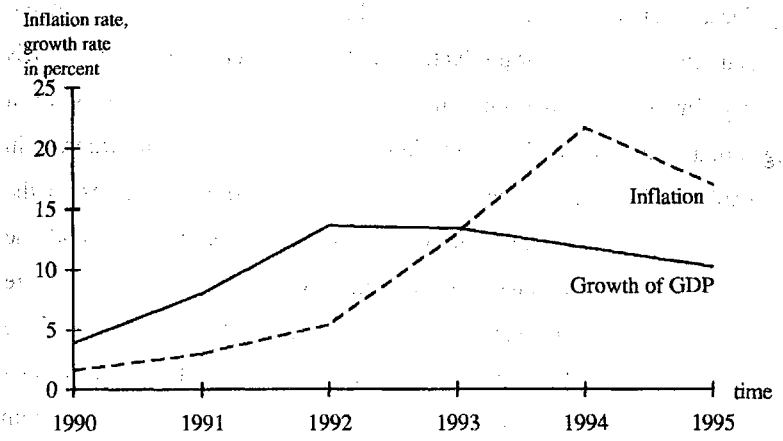
confirmed by the present sample. However, the extent of state interference even in township enterprises suggests a differentiated view of this most dynamic sector of the Chinese economy. Methodologically, the paper tries to improve on the current discussion of total factor productivity (TFP) growth among China's SOEs by allowing for non-neutral technical progress within the framework of a Translog production function with three inputs. I find that technical progress in SOEs is capital using and material saving. This raises some doubts as to the sustainability of China's capital extensive growth path, bearing in mind the country's comparative advantage. Finally, the paper confirms that there are sectoral differences in the performance of China's industrial enterprises. Yet, the sample survey evidence fails to reflect the generally better performance of light industry. In the context of a sluggish regional economy, even sectors with buoyant output growth at the national level perform rather poorly.

The paper begins with an overview over China's macroeconomic and industrial performance during the first half of the 1990s (Section II). Some salient regional differences are highlighted. Section III introduces the enterprise sample. It then proceeds to a qualitative comparison with the coastal sample mentioned above. Section IV carries the empirical analysis of the nature of technical change in the sample. Section V concludes on the results.

II. GROWTH, INFLATION AND GROWING DISPARITIES: CHINA'S MACROECONOMY IN THE 1990S

The first half of the 1990s saw yet another macroeconomic cycle characterised by first rapidly increasing growth rates followed by a bout of inflation and ending in a period of macroeconomic restraint (Figure 1). These cycles have been typical for China's macroeconomic development throughout the reform period. However, this time the government seems to have been relatively successful in containing

Figure 1 — Inflation and Growth Rate in China, 1990-1995



Source: World Bank (1996).

inflation without killing growth, as Gross Domestic Product in 1996 is expected to increase by 9-10 per cent with inflation well down to single digit levels by September this year.

If the first half of the 1990s was a period of rapid growth for China as a whole, the sources of this impressive performance have been highly concentrated along the coastline. Growth in the interior provinces has been far lower than the national average. Particularly in the Northeastern industrial heartland and the Western provinces bordering on Central Asia, structural legacies from the period of central planning have hindered the development of a dynamic non-state sector in light industry which is responsible for much of the growth in the economy as a whole. As Raiser (1996) shows, these structural legacies combined with a distortionary system of inter-provincial fiscal transfers have prevented the convergence of per capita incomes among interior provinces and thereby have accentuated the existing income gap between the coast and the interior. Table 1 bears evidence to

this observation. It displays the growth of total industrial output and industrial output in SOEs for 1990-1994, and the share of SOEs and heavy industry in industrial output in 1994 for China as a whole and for the three interior provinces in which the enterprise sample studied below is located.[3] The share of industrial output emanating from SOEs and heavy industry is above the national average in

Table 1 — Industrial Output Growth 1990-1994, Share of State-Owned Enterprises in 1994, Share of Heavy Industry in 1994, Total China, Three Interior Provinces, Selected Industrial Sectors

	Growth of industrial output 1990-1994 (1990=100)				Share of SOEs in per cent 1994	Share of heavy industry in per cent 1994
	Total constant prices	Total current prices deflated by official PPI	SOEs constant prices	SOEs current prices deflated by official PPI		
China	169.9	190.8	126.0	137.4	34.1	39.7
Jilin	134.9	165.2	122.2	141.3	62.4	61.3
Shanxi	124.4	161.2	116.2	135.2	43.7	50.5
Sichuan	164.3	221.2	114.6	142.5	37.1	43.6
Food	142.8				51.1	
Textiles	147.2				37.5	
Garments	274.5				7.0	
Leather	252.7				11.5	
Paper	191.0				24.8	
Chemicals	170.0				41.4	
Materials	185.8				30.0	
Metallurgy	138.2				54.2	
Machinery	177.3				46.5	
Electronics	195.7				31.3	

Source: Naughton (1996: 1090); SSB (1991; 1995).

[3] Of the three provinces, Jilin and Shanxi belong to the Northeastern region while Sichuan is located in the Southwest. Jilin is a traditional industrial center since the pre-World War II period, Shanxi is a major coal producing area, while Sichuan was one of the provinces most involved in the militarisation and industrialisation of the West of China during the 1960s.

all three provinces, with Northeastern Jilin standing out as the most "traditionally socialist" of the three. Note that growth rates are given both at constant prices as published by the State Statistical Bureau (SSB, 1991; 1995) and at current prices deflated by the national industrial producer price index, also published by SSB (various issues). Growth at constant prices is on average about 3 per cent per annum above growth at current prices deflated with the official price index. This statistical discrepancy highlights the critical role of choosing the right deflator in gauging China's industrial growth performance (Rawski, 1991; Woo et al., 1994). I will come back to it in detail below.

Other indicators confirm the regional differences in economic performance. For instance, the ratio of the share of total SOE losses to the share of national industrial output by province is above one in 15 provinces, of which 6 are located in the Northeast and another 6 in the West or Southwest (Broadman, 1995). All three provinces hosting the present enterprise sample belong to this group, the ratios being 1.6, 1.9, and 1.2 in Shanxi, Jilin, and Sichuan respectively. As mentioned above, structural legacies are partly responsible for this inferior performance. The lower panel of Table 1 displays growth rates of industrial output and the share of SOEs by sector. Thereby, the Chinese industrial classification has been aggregated to ten sectors within manufacturing. These aggregates are the same as will be used in the sectoral analysis of the survey data below.[4] The aggregation hides some variation among smaller aggregates. Nevertheless, the

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[4] The sectoral aggregates were formed as a weighted sum of the following industrial classifications:

Food = food processing, food manufacturing, beverage manufacturing
Paper = timber processing, furniture manufacturing, papermaking and paper products
Chemicals = raw chemical materials and chemical products, pharmaceuticals, chemical fibres, rubber products, plastic products
Metallurgy = smelting and pressing of ferrous and non-ferrous metals, metal products
Machinery = ordinary machinery, special purpose equipment, transport equipment
Electronics = electrical equipment and machinery, electronics and telecommunications
Textiles, garments, and building materials were not further aggregated.

broad trend of lower growth in heavy industry and particularly in those sectors where SOEs are dominant emerges very clearly from the Table.

In addition to structural differences, differences in the implementation of enterprise reforms might explain part of the variation in regional economic performance. Because most SOE losses are still financed by the center through fiscal transfers or central bank policy loans, regional governments may have few incentives to press for efficiency improvements, particularly as the social costs of restructuring such as unemployment would be borne mainly at the local level.[5] This interaction between structural conditions and reform implementation can be tested with microeconomic data on the operating environment of SOEs located in different provinces of China. Raiser (forthcoming) performs such a comparison for the four cities of Guangzhou, Shenzhen, Xiamen, and Shanghai and finds a much lesser degree of autonomy in Shanghai that corresponds to that city's higher share of SOEs and closer fiscal interdependence with the central government. The availability of qualitative survey data based on exactly the same questionnaire for three interior provinces provides an ideal opportunity to further verify this correspondence.

III. GOVERNMENT-ENTERPRISE RELATIONS IN THE INTERIOR

The data used in the remainder of this paper come from an enterprise survey of SOEs, collectively-owned enterprises (COEs), township and village enterprises (TVEs), private enterprises, and a few shareholding companies (in which the state typically has majority ownership through various levels of government) carried out by members of the Institute of Economics of the Chinese Academy of Social Sciences in the year 1995. The questionnaire was returned by 372 enterprises

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5 Qiang and Roland (1994) make the same argument in the context of fiscal decentralisation which is said to harden the budget constraints of local governments. In the case of Chinese interior provinces less decentralisation may imply a softer budget constraint and hence less willingness to implement painful reforms (Raiser, forthcoming).

distributed over 34 sectors of Chinese industry. Of these 365 enterprises will be used in the analysis of the qualitative data by ownership in this section (seven enterprises did not report their ownership). In the analysis by industrial sector another 21 cases are lost because they did not belong to any of the 10 major sectoral aggregates.

Table 2 presents the distribution of enterprises by ownership, location, and industrial sector. The sample is clearly dominated by SOEs, which make up 72.9 per cent of all enterprises. COEs account for 16.2 per cent, TVEs for 7.1 per cent and 1.9 per cent are private and shareholding companies respectively. The distribution across sectors reveals a concentration in chemicals and machinery which reflects the more heavy industrial orientation of the interior provinces under study. The ownership distribution is comparatively even across all sectors in contrast to the specialisation of non-state enterprises in light industry observed at the national level. However, as pointed out by Oi (1996), TVEs are far from a homogenous group. Indeed, TVEs in the present sample are in many respects quite similar to SOEs, cautioning against lumping them together with private ownership forms. Finally, the distribution across provinces shows a below average representation of TVEs in Jilin. This mirrors the earlier observation that Jilin is the most "traditionally socialist" of all three provinces.

The qualitative questionnaire contains three major sets of questions. The first asks about the management form of the enterprise and the structure of decision making authority in various areas of enterprise management. The second set enquires about the determinants of enterprise profitability and the reaction to competition. The third set requires managers to subjectively judge the level of capacity utilisation and optimal employment in their enterprise. The first two sets are analysed in this section only with respect to ownership differences and to differences between coastal and interior SOEs. The survey does reveal some sectoral differences, but

Table 2 — Distribution of Enterprise Sample by Ownership, Location and Industrial Sector, Number of Firms

Ownership	SOEs	COEs	TVEs	Private	Shareholding
Jilin	114	30	3	1	2
Shanxi	42	7	7	3	3
Sichuan	110	22	16	3	2
Food	27	9	2	–	1
Textiles	26	6	–	–	–
Garments	8	5	5	2	2
Leather	4	2	–	–	–
Paper	19	5	2	1	–
Chemicals	34	15	5	2	–
Building materials	22	2	5	1	–
Metallurgy	16	1	–	–	–
Machinery	61	9	2	–	1
Electronics	29	3	1	1	1
Other	20	2	4	–	2
Total number of firms	266	59	26	7	7

Source: Enterprise survey data, interior sample.

they are overall too small to be worth reporting. Excess employment is analysed in Section IV.

Table 3 reports the distribution of enterprises by management form in 1990 and 1994. Five management forms are distinguished, namely shareholding, contract responsibility, leasing, director responsibility, and corporation.[6] In 1990, most

6 Some clarification of these classifications is in order. Shareholding companies present the latest stage in current enterprise reforms. They may be owned in part by private investors (in which case they fall under the ownership category "shareholding") or by various levels of government (which is why these groups also report shareholding as one possible management form). It is not entirely clear why some shareholding enterprises report other management forms. It is likely that the distinctions to SOEs or COEs are often fuzzy. Corporatisation involves the delegation of full financial responsibility to the enterprise level, including the possibility of bankruptcy. It is also a fairly recent phenomenon. For details on the other management forms see Hay et al. (1994) and Bohnet et al. (1994).

Table 3 — Management Form by Ownership, 1990 and 1994, in per cent

Year / Ownership	1990					1994				
	SOEs	COEs	TVEs	Private	Share-holding	SOEs	COEs	TVEs	Private	Share-holding
Share-holding	1.5	3.6	8.3	14.3	71.4	4.2	3.6	8.0	14.3	85.7
Contract respon-sibility	80.5	67.4	45.8	0	14.3	26.4	21.8	20.0	0	0
Leasing	6.1	14.5	25.0	0	0	5.0	5.5	20.0	0	0
Director respon-sibility	9.6	14.5	16.7	14.3	14.3	46.4	60.0	48.0	14.3	14.3
Corpora-tion	2.3	0	0	0	0	1.9	5.5	0	0	0
Other	0	0	4.2	71.4	0	16.1	3.6	4.0	71.4	0
Total number of firms	261	55	24	7	7	261	55	24	7	7

Source: Enterprise survey data, interior sample.

SOEs were under the contract responsibility system, whereas by 1994, the largest proportion was under director responsibility. The same shift over time may be observed among COEs and TVEs, although to a lesser extent. This result contrasts with the coastal sample analysed in Raiser (forthcoming) where the share of enterprises under director responsibility declined from over 80 per cent in the mid 1980s to 57.3 per cent in 1992. It is not clear whether this shift had any implications for the operating environment of the enterprises concerned, however. Hay et al. (1994) fail to find significant differences in a sample of 700 SOEs for the late 1980s. I have also broken down the information on autonomy by management form in the present sample and find no significant differences between the contract and the director responsibility system. The other management forms pertain chiefly to TVEs, private enterprises and shareholding companies. It is noteworthy that inspite of the 1993 regulations on the future

reform of state enterprises, which envisages the corporatisation of large and medium scale SOEs, the share of this management form has not increased in the sample. The proportion of SOEs reporting "other" management forms has, however, greatly increased, suggesting that some changes might have occurred in the corporate governance structures of the enterprises concerned.

Table 4 turns more directly to enterprise autonomy and asks for the decision making authority over a variety of areas. Six forms of authority are distinguished, namely decision making by the firm, the supervisory authority, joint decision making between the firm and the supervisory authority, decision making by the director, by the executive board, and by the workers' council. Overall, 17 areas of decision making were distinguished in the questionnaire, 7 of which concern investment and production and are reported in Table 4. Table 5 deals with employment and wage decisions.[7] With respect to investment, Table 4 reveals that 64 per cent of all SOEs made investment decisions without administrative interference (the sum of columns 1, 4 and 5). This is a remarkably high number, considering the general perception that investment is still the most important target for Chinese economic planning (Naughton, 1996). Moreover, this figure is substantially above the result for the coastal sample, obtained two years earlier which is reported in the lowest row of each panel (39 per cent of SOEs in the coastal sample reported no administrative interference in investment). However, the figures for the interior sample in Table 4 are put in some doubt by a companion question that asked for the maximum scale of investment that enterprises could decide on their own. A vast majority of all surveyed enterprises reported restrictions in this area. Another possible reason for the surprising degree of

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7 The five areas that are not reported are: type of technology to employ, source of equipment, source of raw materials, level of non-plan output, internal employee assignment. In all these areas, decision making was typically located either with the firm or the director. The differences to the coastal sample were marginal.

Table 4 — Ownership and Autonomy in 1994: Investment and Production Decisions, Distribution of Firms in per cent[a]

Decision about	Ownership	Decision making authority					
		Firm	Supervisory authority	Joint authority	Director or board of directors	Standing committee of shareholders	Workers' council
1) New investment	SOEs	56	18	18	6	2	0
	COEs	71	7	12	10	0	0
	TVEs	77	0	15	8	0	0
	Private	71	0	0	29	0	0
	Shareholding	14	0	0	0	86	0
	Coastal SOEs	22	12	47	5	12	1
2) Sources of funds	SOEs	73	4	14	10	0	0
	COEs	71	3	14	12	0	0
	TVEs	73	0	19	8	0	0
	Private	86	0	0	14	0	0
	Shareholding	29	0	43	0	29	0
	Coastal SOEs	29	8	37	20	5	1
3) Production/ new products	SOEs	77	2	11	8	2	0
	COEs	75	0	9	17	0	0
	TVEs	92	0	4	0	4	0
	Private	86	0	0	14	0	0
	Shareholding	71	0	0	0	29	0
	Coastal SOEs	64	1	11	21	2	–
4) Abandoning old products	SOEs	75	2	13	9	1	0
	COEs	76	0	7	17	0	0
	TVEs	92	0	4	0	4	0
	Private	86	0	0	14	0	0
	Shareholding	57	0	0	14	29	0
	Coastal SOEs	62	1	12	22	2	1

contin. Table 4:

Decision about	Ownership	Decision making authority: Firm	Supervisory authority	Joint authority	Director or board of directors	Standing committee of shareholders	Workers' council
5) Sales outside plan	SOEs	82	0	7	10	0	0
	COEs	83	0	0	17	0	0
	TVEs	89	0	0	8	0	4
	Private	86	0	0	14	0	0
	Shareholding	71	0	14	0	14	0
	Coastal SOEs	67	1	4	24	2	0
6) Price of market sales	SOEs	74	2	14	10	0	0
	COEs	80	0	9	12	0	0
	TVEs	81	0	12	4	0	4
	Private	86	0	0	14	0	0
	Share holding	29	0	43	0	29	0
	Coastal SOEs	65	2	10	20	1	0
7) Export level and direction	SOEs	73	8	16	3	1	0
	COEs	69	6	25	0	0	0
	TVEs	71	4	8	13	4	0
	Private	67	0	33	0	0	0
	Shareholding	17	0	17	0	67	0
	Coastal SOEs	51	5	22	17	0	0

[a] Row totals do not sum to 100 per cent, as some unspecified residual category was also included as possible answer.

Source: Enterprise survey data, interior and coastal samples.

investment autonomy in the present sample might be that the overall macroeconomic environment was relatively permissive at the time of the interview. Even among non-SOEs, the proportion reporting administrative restrictions among the interior sample is lower than among non-SOEs along the coast, although the latter included a substantial number of joint ventures and foreign

Table 5 — Ownership and Autonomy in 1994: Employment and Wage Decisions, Distribution of Firms in per cent[a]

Decision about	Ownership	Decision making authority					
		Firm	Supervisory authority	Joint authority	Director or board of directors	Standing committee of shareholders	Workers' council
1) Total labour force	SOEs	7	27	62	2	2	1
	COEs	19	26	48	5	0	0
	TVEs	46	4	12	31	8	0
	Private	43	0	0	57	0	0
	Shareholding	14	14	14	14	43	0
	Coastal SOEs	50	4	20	21	1	2
2) Source of employment	SOEs	5	6	85	3	4	0
	COEs	9	2	83	3	0	0
	TVEs	46	0	27	27	0	0
	Private	43	0	14	42	0	0
	Shareholding	14	0	57	14	14	0
	Coastal SOEs	47	4	27	21	0	1
3) Total wages for each worker	SOEs	10	8	34	32	3	13
	COEs	3	5	5	68	0	17
	TVEs	4	4	4	77	0	8
	Private	44	0	14	29	0	0
	Shareholding	43	0	0	29	14	0
	Coastal SOEs	39	11	17	19	0	15
4) Total bonus for each worker	SOEs	11	0	0	78	1	10
	COEs	5	0	0	80	0	15
	TVEs	12	0	0	81	0	8
	Private	57	0	0	29	0	14
	Shareholding	29	0	0	57	14	0
	Coastal SOEs	56	2	5	26	1	10

contin. Table 5:

Decision about	Ownership	Decision making authority: Firm	Supervisory authority	Joint authority	Director or board of directors	Standing committee of shareholders	Workers' council
5) Dismiss workers	SOEs	2	2	2	27	2	65
	COEs	0	2	0	48	2	47
	TVEs	0	0	0	77	4	19
	Private	29	0	14	43	0	14
	Shareholding	14	14	0	14	0	29
	Coastal SOEs	39	3	13	27	0	18

[a] Row totals do not sum to 100 per cent, as some unspecified residual category was also included as possible answer.

Source: Enterprise survey data, interior and coastal samples.

owned enterprises which would be expected to be more autonomous than COEs and TVEs. The substantial autonomy of SOEs in the sources of investment funds is easily explained by the dominant role of self-financing in the investment process. Again, autonomy is higher in the interior sample, probably for similar reasons as in the case of investment.

With respect to production decisions, Table 4 suggests that the central plan has virtually stopped to play a role in determining the level and price of output even among SOEs. Less than 15 per cent of SOEs cannot freely decide to produce a new product or abandon an old product. Slightly more SOEs are constrained in the price they charge on the free market. Generally, autonomy in this area is higher than in investment, mirroring a result from the coastal sample. The supervisory authority does tend to interfere more in export decisions, where 23.5 per cent of enterprises report joint decision making or decision making by the supervisory authority alone. As in the case of new investments, the autonomy of COEs and TVEs is generally higher still than that of SOEs. Particularly noteworthy is the large percentage of enterprises under shareholding ownership

reporting restrictions in the price of market sales. As mentioned before, shareholding companies typically remain in the hands of some level of government. They usually produce in very sensitive product areas such as the domestic computer industry or in scientific research.[8] The introduction of new corporate governance structures thus does not guarantee a real change in the operating environment of the enterprise concerned (see also Broadman, 1995). Indeed, selection for an experiment in a new form of enterprise-government relations suggests that the enterprise chosen already is a an above average performer benefiting from particular attention but correspondingly suffering from substantial interference from the central and provincial governments.

The labour market offers the most interesting contrast both between ownership groups in the present sample and of SOEs in the interior to SOEs in the coastal sample. In the three interior provinces, 62 per cent of SOEs and still 48 per cent COEs reported joint decision making with supervisory authorities concerning the total labour force, and in more than a quarter of all cases enterprises in these two ownership categories could not influence their level of employment at all. By contrast, only 15 per cent of TVEs and less than 30 per cent of shareholding companies reported administrative interference in this area. In the coastal sample, the percentage of SOEs experiencing restrictions was 31 per cent. This general pattern is repeated in decisions about the sources of employees. Less than half of SOEs and COEs in the interior sample are restricted in determining the wage level for each type of worker (although administrative interference in SOEs is still more frequent than along the coast) and none at all face administrative interference in determining bonuses. Worker councils have some influence both over wages and bonuses, notably so in COEs. More importantly, worker councils are

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8 One such company was presented to the author as a model for the success of the latest SOE reforms in Jilin province. It had close links to Changchung university and the Chinese Academy of Social Science and stood under the direct protection of the State Planning Commission.

dominant in decision making about dismissal in both SOEs and COEs. This contrasts to other ownership forms in the present sample and to SOEs along the coast. The influence of worker councils in this area is worrisome, as it is likely to prevent employment restructuring in loss-making enterprises. The extent to which this has caused overemployment in SOEs and COEs is briefly analysed below. The overall impression that labour markets are the least reformed area in enterprise decision making in the present sample is finally supported by the fact that this is the only area where private enterprises face any restrictions at all.

The preceding discussion has uncovered important differences in the operating environment of SOEs and other ownership forms, as well as SOEs in the coastal provinces of China. To what extent this has affected the performance of SOEs in the interior and the coast and of other ownership forms may be gauged from managers' responses to the questions what were the major influences behind a change in profitability and the failure to reach maximum capacity. Table 6 reports answers to the first question (most important cause of change in profitability). 16 possible reasons were suggested. The first important result is that SOEs and COEs do not seem to complain about a lack of autonomy as a determinant of profitability. Rather, TVEs seem most affected by government interference. An unambiguous interpretation of this result is difficult. It might suggest that a lack of autonomy of SOEs is compensated for by government subsidies. The responses of TVEs also demonstrate the scope for government interference even in this sector which is usually classified as quasi-private by analysts of Chinese industrial performance (e.g. Sachs and Woo, 1994). It is possible that locational factors overweigh ownership differences in this respect, supporting the view of more conservative reform policies in the interior. Less speculative is an interpretation of differences between coastal and interior SOEs. Roughly a third of interior SOEs (and COEs) quote product quality and access to information on factor and product markets as important determinants of profitability while this

Table 6 — The First Most Important Determinant of Enterprise Profitability by Ownership, per cent of Subsample

	SOEs	COEs	TVEs	Private	Share-holding	Coastal SOEs
Demand factors						
1) Change in level of market demand	19	18	4	14	29	44
2) Change in structure of market demand	13	14	0	14	14	7
Management factors and autonomy						
3) Autonomy in production	4	0	16	0	29	–
4) Autonomy to set prices	3	4	8	14	0	3
5) Information on markets	11	16	20	29	0	5
6) Foreign exchange and import license	2	0	4	0	0	3
7) Access to export markets	0	0	0	29	0	1
Factors related to production						
8) Material costs	9	5	8	0	14	10
9) Availability of investment funds	1	0	0	0	0	–
10) Availability of working capital	8	5	16	0	0	11
11) Quality of products	19	18	16	0	0	3
12) Capacity	1	5	4	0	14	1
13) Level of technology	1	5	0	0	0	–
14) Availability of skilled workers	9	12	0	0	0	3
15) Supply of raw materials	1	0	4	0	0	7
16) Supply of energy	0	2	0	0	0	–
17) Others	0	0	0	0	0	3

Source: Enterprise survey data, interior and coastal samples.

proportion is only 8 per cent in the coastal sample. For coastal SOEs, demand factors are by far the most important determinants of profitability. Arguably, this reflects differences in the efficiency of production and in the market orientation of

the two samples, although part of the explanation may also be that the coastal sample was interviewed in 1992 when memories of the 1990-1991 recession were still fresh, while 1995 (the date of the interior sample survey) was a year of relatively rapid growth.[9] The only ownership group in the interior sample that displays a comparable sensitivity to demand factors as the coastal SOEs are shareholding companies which, as mentioned before, are among the technologically most advanced of Chinese enterprises.

The contrast between SOEs in the coastal and interior samples is brought out most clearly by Table 7 which asks for the major reason that enterprises failed to reach maximum capacity. Over a third of SOEs in the interior report competition from better quality or cheaper products as the main reason for their failure to produce their potential output. The proportion of non-SOEs in the interior naming competition as the major constraint on capacity utilisation is considerably lower. The comparison to the coastal sample reveals that only 13 per cent of coastal SOEs were affected by competition. Unfortunately, over 50 per cent of coastal SOEs either gave three of more reasons at the same time or quoted other unspecified reasons in answer to the question. But even when all responses which include competition among various other causes of suboptimal capacity utilisation are added to the cases in row two, the proportion of coastal SOEs affected by competition rises to only 19 per cent.[10] In the other areas the differences are not as accentuated. Noteworthy is the high percentage of TVEs affected by materials and energy supply bottlenecks which shows their continuous discrimination in product markets still largely controlled by state trading.

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9 In answers to the question what were the main reactions to increased competition (not reported here for reasons of space), managers of the coastal SOEs quoted improved product quality far more often than interior SOEs. This underlines the interpretation that structural difficulties interact with a more restrictive administrative environment in making life more difficult for SOEs in the interior than along the coast.

10 Competition is not the major factor among the cases included in row seven. The largest proportion of coastal SOEs in this category quoted a combination of insufficient overall demand and several supply bottlenecks.

Table 7 — Causes for Failure to Real Maximum Capacity by Ownership, in percent

	SOEs	COEs	TVEs	Private	Share-holding	Coastal SOEs
1) Insufficient demand	37.4	44.6	26.0	40.0	50.0	26.9
2) Competition from better or cheaper products	34.7	26.4	13.0	20.0	0	13.0
3) Inadequate materials supply	10.1	8.8	26.0	0	0	6.5
4) Inadequate electricity supply	8.2	5.3	17.4	20.0	25.0	1.3
5) Inadequate coal, oil, other energy supply	3.1	5.3	13.0	0	0	1.3
6) Inadequate transport	1.2	1.8	0	0	0	0
7) Combination of factors (three or more)	3.4	4.3	8.9	0	25.0	34.3
8) Other	1.9	3.5	0	20.0	0	16.7

Source: Enterprise survey data, interior and coastal samples.

The above evidence is suggestive of significant differences in the operating environment of SOEs in the interior and coastal provinces of China. This regional differentiation has so far not been exploited in quantitative studies of SOE performance. My earlier research (Raiser, forthcoming) found that efficiency improvements among SOEs in the coastal sample were moderately positive over the 1980-1992 period (see also Perkins, 1996). The evidence in Table 6 and 7 above suggests that interior SOEs face more pronounced adjustment problems and remain under tighter government control (at least with respect to the labour market). They may thus be expected to perform below average. The following section examines TFP growth in the present sample and demonstrates that indeed the economic performance of interior SOEs has been disappointing.

IV. ECONOMIC PERFORMANCE IN A SAMPLE OF INTERIOR ENTERPRISES

a) Descriptive Statistics

This section starts with some summary statistics by ownership and industrial sector. Data for private and shareholding companies are not reported as the sample sizes are too small for statistical inference. Table 8 reports information on average employment, labour productivity, capital intensity, average wage, and average total worker compensation. Enterprise size, as given by average employment, varies greatly across both ownership and industrial sectors. SOEs are on average almost three times as large as COEs or TVEs. Among industrial sectors, average employment is increasing with capital intensity. However, in the case of ownership this correlation is reversed as TVEs are more capital intensive than SOEs in the present sample. This is certainly not representative for China as a whole, but it may help to explain some unexpected results of the qualitative questionnaire relating to the degree of administrative interference in TVEs. The TVEs in this sample seem to belong to the group of established industrial enterprises on the outskirts of major industrial towns rather than to the group of rapidly expanding rural workshop type establishments.[11] In line with their higher capital intensity, TVEs in the present sample do also have substantially higher labour productivity. There is no correlation of capital intensity and labour productivity at the sectoral level, however. Wages are more or less equal across all subsamples, variations in worker compensation coming primarily from welfare payments in kind, most importantly housing. Total worker compensation is consequently higher in SOEs than in COEs or TVEs.

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[11] One TVE that I visited had actually become the major producer of radiators in Jilin province with customers all across Northeastern China. It had recently bought its major competitor, a financially weak COE located in an adjacent urban district. Relations to the municipal government bodies were extensive, and considered helpful.

Table 8 — Sample Descriptives: Average Employment, Labour Productivity, Capital Intensity, and Average Worker Compensation, 1990-1994 Averages

	Average Employment Persons	Real Gross Output per Worker in Yuan	Capital Stock per Worker in Yuan	Average Wage in Yuan	Average Total Worker Compensation[a] in Yuan
By ownership					
SOEs	1456	33466	11700	2434	4312
COEs	616	27194	10400	2316	3660
TVEs	573	53862	17000	2557	3218
By industry					
Food	1043	34695	10200	2339	3547
Textiles	1653	32129	10600	2593	3992
Garments	971	57193	8800	2251	3072
Leather	767	24618	11500	2145	3077
Paper	800	29439	9700	2259	4182
Chemicals	989	39837	14500	2389	4014
Building materials	881	27372	10400	2499	3808
Metallurgy	1527	37895	11900	2293	4127
Machinery	1572	28810	12600	2475	4599
Electronics	1254	38715	15600	2597	4709

[a] Includes bonus, housing and other welfare payments.

Source: Enterprise survey data, interior sample.

Table 9 turns to some quantitative evidence on enterprise profitability, excess employment, and worker incentives. The average net rate of return (gross profits minus all taxes paid over the net value of fixed assets) is around 7 per cent in both SOEs and COEs but 13 per cent in TVEs. This does not point at serious financial fragility in many SOEs, although it confirms the better performance of TVEs in previous studies. The fact that not a single enterprise in the sample reported negative net profits does, however, suggest some caution in the interpretation of the financial data. An alternative way to look at enterprise financial performance is to compute the net income tax rate, calculated as the difference between total taxes and sales taxes over net value added. 6.2 per cent of SOEs in the sample reported a negative number, indicating serious financial

Table 9 — Sample Descriptives: Profitability, Taxation, Excess Employment and Worker Incentives, 1990-1994 Averages

	Net Profit Over Net Fixed Capital Stock in per cent	(Total Tax – Sales Tax)/ Net Value Added in per cent	Optimal Employment/ Current Employment[a]	(Average Bonus + Overtime Pay)/ Average Wage
By ownership				
SOEs	7.42	16.6	0.86	0.214
COEs	7.57	15.5	0.82	0.219
TVEs	12.96	20.5	0.89	0.191
By industry				
Food	5.95	11.9	0.76	0.234
Textiles	8.57	19.6	0.79	0.201
Garments	28.37	12.9	0.94	0.168
Leather	3.37	7.5	0.86	0.249
Paper	11.70	14.7	0.82	0.194
Chemicals	7.83	21.3	0.87	0.232
Building materials	4.04	12.5	0.90	0.206
Metallurgy	9.48	22.0	0.89	0.195
Machinery	4.91	18.9	0.88	0.207
Electronics	5.59	15.1	0.87	0.222

[a] Optimal employment was estimated by managers in the qualitative questionnaire.

Source: Enterprise survey data, interior sample.

difficulties. The average net income tax rate is below that in TVEs, although COEs pay even less in average taxes. The variations in net income tax rates across industrial sector do not match well with the data on profitability, again urging for a cautionary interpretation of the financial data. Possibly the most accurate indicator of financial stress may be the data on overemployment, reported by managers in the qualitative questionnaire. As shown below, excess labour is one determinant of variations in enterprise efficiency. SOEs report a higher average level of overemployment (14 per cent) than TVEs (11 per cent), but COEs have the highest average overemployment with 18 per cent of the labour force considered redundant by managers. These results square well with the qualitative results on administrative restrictions in the labour market reported in Table 5, although one might have expected even larger differences. The highest

overemployment across sectors is recorded in food (24 per cent) and textiles (21 per cent), the lowest in garments (10 per cent).[12] Table 9 finally shows that the ratio of average bonuses plus overtime pay to the average wage does not vary much across ownership or sector. In particular, it shows little relation to either profitability or excess employment and is almost as high in TVEs as in SOEs. Bonuses were originally devised as an incentive scheme to encourage increased worker effort. They are usually paid out of retained profits and should therefore display some sectoral variation. As such variation is minimal in the sample, it is doubtful that bonuses still fulfil the role of a positive incentive. Instead they seem to have become an expectedly permanent part of worker remunerations.

b) Output Growth and the Issue of Deflation

Table 10 turns to the growth of output in the sample. This is in principle the most direct way to gauge economic performance but, because growth rates are strongly affected by the use of deflators, their discussion warrants some closer attention. Table 10 displays four columns giving measures of the average growth rate of gross and net value of output at constant prices and at current prices deflated by the official producer price index respectively, and two columns presenting data on average capital and labour input growth. As already observed in Table 1, output growth at constant prices is substantially above growth at current prices deflated with the official price index in all subsamples. It is well known that Chinese output data at constant prices may overstate true output growth by a significant margin (Rawski, 1991; Woo et al., 1994). On the other hand, the official producer price index displays a degree of sectoral variation that is at least surprising for the first part of the 1990s, when the great majority of sales already occurred at market prices. This point is brought out by Table 11 giving the

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[12] This squares well with this sector's high profitability. But neither correlation to the two financial indicators is high across sectors.

Table 10 — Average Output Growth Using Official and Enterprise Specific Deflators, Growth of Capital and Labour Inputs, 1990-1994

	Growth rate in per cent					
	Gross Value of Output		Net Value of Output		Employment	Net Capital Stock
	constant prices	current prices deflated by official PPI	constant prices	current prices deflated by official PPI		
By ownership						
SOEs	1.11	-2.42	0.00	-3.46	1.30	5.15
COEs	2.47	0.12	0.45	-1.90	1.06	3.76
TVEs	2.64	-0.61	0.33	-2.92	1.77	9.90
By industry						
Food	1.52	-2.39	0.00	-3.85	1.48	5.01
Textiles	0.00	-2.84	-0.77	-3.69	1.07	4.37
Garments	0.12	-3.41	-1.43	-4.99	1.73	5.93
Leather	-0.77	-6.24	-2.65	-8.12	0.06	3.41
Paper	1.99	4.34	0.21	2.56	0.07	6.16
Chemicals	2.30	2.29	0.47	0.45	2.26	6.44
Building materials	0.81	-7.55	3.88	-7.98	0.11	4.23
Metallurgy	4.68	-8.11	2.49	-10.30	2.54	6.72
Machinery	1.00	-0.75	0.00	-1.71	1.05	4.10
Electronics	2.62	-3.94	1.06	-5.50	1.21	7.97

Source: Enterprise survey data, interior sample; SSB (var. issues).

official price index and the average enterprise specific price index (obtained by dividing gross output at current prices through gross output at constant prices) for each of the 10 sectors in the present sample. While price increases are more or less equal across sectors using enterprise specific prices, the span in cumulative price increases over the 1990-1994 period amounts to almost 100 percentage points difference using official prices (paper vs. metallurgy). The largest difference between the two series is in the metallurgical industry and in building materials where the inflation differences amount to an average 12.8 and 8.4 percentage points per annum respectively. Returning to Table 10, the impact on output growth rates is dramatic. Using survey data on output in constant prices, gross

Table 11 — Official and Enterprise Specific Price Indices, 1990-1994, 10 Sectors of Chinese Industry[a]

	PPI	DEFQ	PPI	DEFQ	PPI	DEFQ
	Food		Textiles		Garments	
1990	100	100	100	100	100	100
1991	103.3	108.6	104.1	109.2	109	106.5
1992	109.7	119.3	103.4	117.3	109.9	116.0
1993	124.5	127.0	107.3	124.5	129.5	123.3
1994	153.7	132.0	146.8	131.0	150.4	131.0
	Leather		Paper		Chemicals	
1990	100	100	100	100	100	100
1991	109	107.2	102.9	109.7	102.4	107.5
1992	123.	119.8	105.7	119.6	105.2	117.3
1993	137.5	130.1	115.1	129.8	113.9	124.1
1994	167.6	134.8	122.7	135.4	131.4	131.9
	Materials		Metallurgy		Machinery	
1990	100	100	100	100	100	100
1991	106.1	110.7	114.2	107.0	102.8	110.8
1992	117.9	119.6	130.4	118.2	109.6	119.5
1993	160.3	125.5	205.7	122.9	131.2	126.9
1994	181.1	130.1	219.7	132.5	143.6	134.5
	Electronics					
1990	100	100				
1991	106.2	107.8				
1992	113.4	116.8				
1993	140.6	124.1				
1994	160.1	129.9				

[a] Official price index = PPI,
enterprise specific price index = DEFQ.

Source: SSB (var. issues); Enterprise survey, interior sample.

output increases by 4.7 per cent per annum in the metallurgical sector, while it declines by dramatic 8.1 per cent when the official price index is used as the output deflator.

Which deflator should be used? The comparison of value added growth with the growth in capital and labour inputs given in Table 10 might provide a useful clue. It should be noted that capital inputs are recalculated by summing net real

investment over the 1990 figures for the net value of fixed assets, using official province specific price indices for investment goods and depreciation. Both capital and labour inputs increased in the present sample, capital by an average of roughly 6 per cent per year and employment by an average of 1.2 per cent. Neither metallurgy nor building materials show much below average rates of increase in capital or labour inputs. Looking at the growth in the net value of output, one can see that both sectors display slightly above average output growth when enterprise specific prices are used, but dramatic declines when official prices are used. The latter numbers would imply an average decline in TFP of the order of 15 per cent per annum and above which is unrealistic considering the positive overall growth rate in the economy. Unless one would be willing to grant that the present sample is highly unrepresentative for the rest of industry, even in the interior, or that the official growth numbers are entirely wrong, such a divergence of results from regional aggregates seems unacceptable. Hence, although I recognise the potential upward bias in constant price data, I chose to use enterprise specific deflators for the analysis of technical change in what follows. Before turning to this issue, it is worth emphasising that even by the constant price measure output growth was all but insignificant in the present sample. Value added hardly increased at all, and gross output rose by a mere 1 per cent in SOEs and around 2.5 per cent in COEs and TVEs. These are not large growth rates when the national average industrial output growth rate at official prices was 11 per cent. Note that in line with the descriptive statistics given above, growth differences in terms of value added across ownership are not large. At the sectoral level, textiles, garments and leather stand out as the worst performers, while heavy industry records above average growth rates. The bad performance of garments in particular contrasts to the national trend given in Table 1. It seems that the interior location of the sample overweighed industry specific factors, a result that could indicate the importance of local reform inplementation.

c) The Nature of Technical Progress

I now turn to the analysis of technical progress in the sample.[13] For this purpose, I estimate three factor input production functions, using both the Cobb-Douglas and the more flexible Translog specification. The use of three inputs allows for a richer specification of substitution possibilities in the Translog production function and moreover enables me to analyse biases in the direction of technical change. This comes at the cost of reintroducing the deflation issue, as materials were only given at current prices and no enterprise specific materials price index was available. I opt for the solution suggested by Woo et al. (1994), namely to deflate materials with the enterprise specific output deflator. This assumes no change in relative materials-output prices which may not be entirely unrealistic for the 1990s. The justification given by Woo et al. (1994) is that if output at constant prices contains an upward bias, the use of a downward-biased output price deflator for materials might just mutually offset the resulting bias in TFP growth rates. To what extent this also applies to my computations of non-neutral technical progress is a matter that cannot be resolved for the present survey data.

The specifications to be estimated are, for the Cobb Douglas function:

1) $$\ln Y_{it} = \ln A + \alpha \ln K_{it} + \beta \ln L_{it} + \gamma \ln M_{it} + v_{it} - (u_i - \mu_{it})$$

where: A = technology constant,

Y_{it} = real gross output value,

K_{it} = real net capital stock,

L_{it} = total employment,

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13 This will be taken to include both exogenous technical change and efficiency improvements over the sample period. While in principle, using panel data, the separate econometric estimation of technical change and efficiency change is possible, in short panels such as ours, the results are generally not consistent (Cornwell and Schmidt, 1996).

M_{it} = real value of raw material inputs,

v_{it} = white noise error term,

u_{it} = firm specific efficiency level,

μ_i = random disturbance of firm specific efficiency;

and for the Translog function:

2)
$$\ln Y = \ln A + \sum_{j=1}^{n} \alpha_j \ln X_j + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \beta_{jk} \ln X_j \ln X_k + \lambda_t + \frac{1}{2} \lambda_t t^2 + \sum_{j=1}^{n} \lambda_j \ln X_j \cdot t + \varepsilon$$

where: $X_{j,k}$ = are vectors of n inputs (n=3)

t = is time,

ε = $v_{it} - (u_i - \mu_{it})$ as in equation 1)

and time and individual subscripts have been omitted for clarity of presentation.

In the latter case, the rate of technical progress (RTP) may be computed as the derivative of 2) with respect to time (Kumbhakar and Hjalmarsson, 1993: 258-259):

3) $$RTP = \frac{\partial \ln Y}{\partial \ln t} = \lambda + \lambda_t t + \sum_{j=1}^{n} \lambda_j \ln X_j$$

Furthermore, the bias in technical progress for the jth input is given by:

4) $$\eta_t(j) = \frac{1}{s_j} \lambda_j + RTP$$

where: $\eta_t(j)$ = is the bias in technical change

s_j is the cost share of the jth input.

Technical progress is input j using (saving) if:

5) $$\eta_t(j) > 0 (< 0).$$

Because the data set is in panel format, the estimation of equations 1) and 2) is carried out using the Generalised Least Squares estimator for a random effects model. This allows for firm-specific deviations from the best practise production function in addition to the usual error term. The assumption behind this estimator is that the firm specific effects (which may also be interpreted as individual efficiency estimates) are uncorrelated with the factor inputs. Inspite of the rigour of this assumption, the random effects model is recommended for short panels such as this one (Cornwell and Schmidt, 1996). Moreover, the random effects model allows to include time invarying constant effects, such as subsample dummies in addition to time varying determinants of enterprise efficiency.

Table 12 presents the results of the Cobb-Douglas specification by ownership and industrial sector. An F-test for constant returns to scale is also given. The production elasticities are all positive, the largest contribution to output coming from material inputs. The contribution of capital is insignificant for textiles, materials and metallurgy. Further investments in these three sectors are unlikely to produce large output gains. The production elasticity of capital is also much higher in TVEs and COEs than in SOEs, possibly indicating overinvestment in the latter subsample. The production elasticity of labour is highly significant in all subsamples. It would be tempting to relate the estimated output elasticities to the subsample average factor shares to gauge the extent of allocative inefficiency. However, Kumbhakar (1996) has shown that the combination of efficiency wages and labour market distortions can have offsetting effects on labour allocation which could lead the researcher to wrong conclusions concerning overemployment. For the purpose of the present paper allocative efficiency shall not be further analysed and will be subsumed under the general trend in technical change. This trend is unambiguously negatively in all subsamples except electronics, although significantly so only for SOEs, food, textiles, leather, garments and chemicals. The average rate of decline of 0.5 per cent per annum in

Table 12 — Cobb-Douglas Production Function Estimates, Test for Constant Returns to Scale, Various Subsamples[a]

Subsample	Constant	α	β	γ	t	F-test for constant returns[b]
SOEs	0.865***	0.069***	0.214***	0.696***	-0.005***	2.75*
	(0.091)	(0.013)	(0.018)	(0.011)	(0.001)	(0.098)
TVEs	0.1921***	0.162***	0.159***	0.638***	-0.003	1.936
	(0.180)	(0.033)	(0.036)	(0.023)	(0.003)	(0.165)
COEs	0.917***	0.238***	0.288***	0.455***	-0.015	0.363
	(0.175)	(0.043)	(0.039)	(0.031)	(0.011)	(0.547)
Food	0.774***	0.137***	0.158***	0.696***	-0.011***	0.092
	(0.194)	(0.038)	(0.039)	(0.027)	(0.003)	(0.762)
Textiles	0.595***	0.027	0.194***	0.790***	-0.006**	0.198
	(0.167)	(0.023)	(0.036)	(0.024)	(0.003)	(0.657)
Garments	1.287***	0.118*	0.301***	0.490***	-0.004	4.098**
	(0.287)	(0.070)	(0.079)	(0.042)	(0.019)	(0.046)
Leather	0.937***	0.173***	0.307***	0.488***	-0.019***	2.154
	(0.136)	(0.032)	(0.024)	(0.035)	(0.006)	(0.157)
Paper	0.815***	0.107***	0.139***	0.737***	-0.008*	0.258
	(0.201)	80.039)	(0.036)	(0.027)	(0.005)	(0.612)
Chemicals	0.812***	0.087***	0.246***	0.667***	-0.007**	0.001
	(0.145)	(0.025)	(0.034)	(0.024)	(0.003)	(0.976)
Materials	1.038***	0.067	0.268***	0.623***	-0.003	0.922
	(0.274)	(0.057)	(0.055)	(0.035)	(0.006)	(0.338)
Metallurgy	0.917**	0.069	0.150**	0.755***	-0.006	0.203
	(0.393)	(0.045)	(0.070)	(0.040)	(0.005)	(0.654)
Machinery	0.870***	0.064***	0.192***	0.710***	-0.004	3.461*
	(0.123)	(0.022)	(0.027)	(0.017)	(0.003)	(0.064)
Electronics	1.217***	0.076***	0.173***	0.677***	0.002	4.315**
	(0.241)	(0.031)	(0.047)	(0.031)	(0.004)	(0.039)

[a] Standard errors in parentheses, * = 10, ** = 5, *** = 1 per cent in significance.
[b] Significance levels in parentheses.

Source: Own calculations, interior sample.

SOEs is a little below Woo et al.'s result, who found a 1.4 per cent decline over the 1984-1988 period in a sample of 300 medium to large scale SOEs using exactly the same procedure as the present study. TVEs do not achieve any TFP growth in contrast to all previous studies cited above, pointing again to the

dominance of locational factors in enterprise performance. Finally, constant returns to scale are rejected for SOEs, garments, machinery and electronics.

For the case of garments, this is not very plausible. Increasing returns in the SOE sector gives some support to previous claims that the majority of troublesome SOEs are relatively small and thus suffer particularly from non-SOE competition (Naughton, 1993; Sicular, 1994). Increasing returns in machinery and electronics are compatible with capital intensive production technology and substantial fixed costs.

Table 13 turns to the Translog estimates. Only the terms relevant for the computation of technical change are given to save on space. An F-test tests the Translog function against the Cobb-Douglas function by setting all higher-order terms equal to zero. The Cobb-Douglas specification is retained for COEs, textiles, and metallurgy. The parameter estimates in Table 13 are used to compute the average RTP for each year and each of the remaining subsamples in Table 14. The general picture of declining TFP growth is confirmed by these results. However, the positive coefficient on the squared time variable causes the RTP to increase over time. This could to some extent reflect variations over the business cycle during the sample period which are hidden by the estimates in Table 12. Another interesting contrast to Table 12 is that the RTP is lowest for the electronics industry which was the only industry recording positive technical change in the Cobb-Douglas case. The poor performance of the food sector is further underlined while chemicals perform relatively better. These shifts in relative positions are a reminder of the importance of using appropriate functional forms before drawing far-reaching conclusions.

Looking at the coefficient estimates in Table 13, the biases in technical change across subsamples may be gauged. Because all factor shares are positive and because the RTP is negative in all years, technical progress is factor saving

Table 13 — Estimates of Technical Change, Translog Production Function, Various Subsamples[a]

Subsample	λ	λt	λk	λm	λl	F-test Cobb-Douglas vs. Translog[b]
SOEs	-0.038***	0.005***	0.003***	-0.003*	0.001	8.769***
	(0.013)	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)
COEs	-0.039	0.003	0.001	-0.000	0.002	1.357
	(0.029)	(0.002)	(0.003)	(0.004)	(0.005)	(0.201)
TVEs	-0.072	0.008*	-0.002	-0.001	0.007	22.011***
	(0.044)	(0.005)	(0.004)	(0.007)	(0.008)	(0.000)
Food	-0.073***	0.006***	0.006*	0.004	-0.007	3.528***
	(0.027)	(0.003)	(0.064)	(0.004)	(0.006)	(0.000)
Textiles	0.012	0.001	-0.000	-0.004	0.001	1.533
	(0.020)	(0.002)	(0.002)	(0.004)	(0.005)	(0.133)
Garments	-0.034	0.003	-0.013**	-0.001	0.014	23.756***
	(0.048)	(0.005)	(0.005)	(0.007)	(0.009)	(0.000)
Paper	-0.027	0.001	0.004	-0.001	-0.001	2.347**
	(0.039)	(0.003)	(0.003)	(0.007)	(0.008)	(0.016)
Chemicals	-0.024	0.002	0.001	-0.014***	0.015***	4.058***
	(0.025)	(0.003)	(0.02)	(0.004)	(0.005)	(0.000)
Materials	-0.002	0.001	0.012***	-0.017***	0.003	5.694***
	(0.048)	(0.004)	(0.004)	(0.005)	(0.007)	(0.000)
Metallurgy	-0.0931	0.007	-0.009	0.009	-0.002	1.168
	(0.086)	(0.004)	(0.008)	(0.009)	(0.018)	(0.329)
Machinery	-0.055	0.007	-0.007*	0.002	0.007	4.742***
	(0.024)	(0.002)	(0.004)	(0.003)	(0.004)	(0.000)
Electronics	-0.002	0.005	0.004	-0.012*	0.005	2.645***
	(0.043)	(0.003)	(0.004)	(0.005)	(0.008)	(0.005)

[a] Standard errors in parentheses, * = 10, ** = 5, *** = 1 per cent in significance.
[b] Significance levels in parentheses.

Source: Own calculations, interior sample.

whenever the interactive time-input coefficients in Table 13 are negative (λk, λm and λl). Factor using technological progress results for small absolute values of RTP and a positive interactive coefficient. I restrict the interpretation to those coefficients that are significant at the 10 per cent level. Technical change in SOEs is capital using (at least for the later years) and material saving. This reflects well

the development of factor markets in China. Although the government continues to control the allocation of materials through state trading companies, the sales occur largely at market prices. By contrast, prices for capital are far below market clearing. Over the 1990-1994 period, real bank lending rates were highly negative as inflation soared. From this perspective, the biases in technical change in the SOE sample may have been the result of rational calculation by enterprise managers. However, considering the scarcity of capital in most non-state sectors of the economy and for much needed improvements in public infrastructure, the capital using nature of technical change seems unsustainable in the future. Among the other ownership groups, no statistically significant bias may be detected. The capital using nature of technical change observed in SOEs is repeated in the food and building materials sectors, and materials saving technical change occurs in chemicals, building materials, and electronics. The garments sector stands out as the only sector displaying capital saving technical change which is echoed by an above average output elasticity of capital in Table 12. Finally, the chemicals industry is the only industry showing a positive bias in technical change towards employment which most closely reflects actual factor proportions at the national level.

Table 14 — Rate of Technical Change, 1990-1994, Various Subsamples

	1990	1991	1992	1993	1994
TVEs < SOEs	-0.027	-0.022	-0.017	-0.012	-0.007
TVEs	-0.037	-0.030	-0.021	-0.014	-0.006
Food	-0.048	-0.041	-0.035	-0.028	-0.022
Garments	-0.029	-0.027	-0.025	-0.022	-0.020
Paper	-0.013	-0.012	-0.010	-0.009	-0.008
Chemicals	-0.010	-0.008	-0.006	-0.004	-0.003
Materials	-0.017	-0.015	-0.014	-0.013	-0.012
Machinery	-0.034	-0.028	-0.021	-0.014	-0.007
Electronics	-0.070	-0.067	-0.061	-0.056	-0.052

Source: Table 13, own calculations, interior sample.

The last step in the analysis is to exploit the panel structure of the data in order to identify possible determinants of firm specific efficiency levels. Rather than extracting the firm specific efficiency levels from the residuals of the production function estimates, I introduce potential determinants of enterprise efficiency directly into the production function and test for their significance (for the same approach in the context of Chinese enterprise data, see Groves et al., 1994). In order to obtain reasonably large subsamples, I tested for pooling across industrial sectors based on the Translog specification and obtained four aggregates:[14]

- chemicals, machinery, and electronics
- metallurgy, building materials, and textiles
- food and paper products
- garments and leather.

I tried a large number of variables, a complete list of which is given in the footnote to Table 15. Of the incentive variables tried, only the ratio of bonus and overtime payments to the sum of wages (conventionally interpreted as measuring incentives for increased worker effort) showed any significant correlation with firm specific efficiency levels. The effect is positive for the first two aggregates representing heavy industry, but it is insignificant and even negative in the other two aggregates. Moreover, testing for causality rather than correlation by instrumenting the bonus-wage ratio with its one year lag (see Chetty, Ratha, and Singh, 1994) led to the disappearance of any positive correlation in the first two

[14] F-tests rejected the Cobb-Douglas function for all four aggregates. The F-statistics for pooling across sectors were 1.48, -7.15, -1.01, and -0.44 for the four aggregates respectively, accepting the pooled model at 1 per cent significance in all cases.

Table 15 — Determinants of Enterprise Efficiency in Ownership: Overemployment, Workers' Incentives, Translog Production Function, Pooled Subsamples[a]

Subsample	Chemicals, Machinery, Electronics	Metallurgy, Materials, Textiles	Paper + Food	Leather + Garments
Optimal workforce / actual workforce	0.165*** (0.046)	0.030 (0.056)	0.056 (0.041)	0.051 (0.096)
Share of productive workers in total	0.011 (0.009)	0.020 (0.020)	0.010 (0.018)	0.034 (0.043)
Bonus / wage	0.023** (0.011)	0.026** (0.011)	-0.020 (0.022)	-0.062* (0.036)
TVEs	-0.143 (0.089)	-0.060 (0.148)	0.081 (0.082)	-0.188 (0.122)
COEs	-0.054 (0.068)	-0.052 (0.132)	-0.084 (0.082)	-0.125 (0.120)
Jilin	0.007 (0.051)	-0.009 (0.089)	-0.123* (0.071)	-0.180* (0.095)
Shanxi	0.059 (0.063)	.072 (0.108)	-0.216 (0.144)	0.508** (0.249)
R^2 / Obs.	0.878/662	0.851/297	0.887/230	0.866/82

[a] Standard errors in parentheses, * = 10, ** = 5, *** = 1 per cent in significance.

The full list of variables tried as determinants of enterprise efficiency was: the share of retained profit in total profits, the share of output sold under the plan, the net income tax rate (Table 9), the share of bank credit in the total source of investment, the management form (Table 3), a capital vintage variable and the degree of capital utilisation as quoted by enterprise managers. The insignificance of all these variables is partly due to very small sample sizes because of missing data. See text for more discussion.

Source: Own calculations, interior sample.

aggregates as well.[15] The other variables in Table 15 capture ownership and locational differences on the one hand and effective labour inputs on the other. The ratio of optimal employment to actual employment (see Table 9) has a

[15] The lack of significance of all other incentive variables given below Table 15 is unsatisfactory. Testing alternative specifications such as interactive effects to measure reform complementarity as in Hong and McMillan (1994) goes beyond the scope of the present paper. One promising avenue for future research would be to pool the interior and coastal samples and test for the complementarity of location and specific incentive variables. It is expected that such complementarity should exist for the coastal sample.

positive impact on efficiency, although with little significance except for the first aggregate. This is at least suggestive of an overemployment problem, which would square well with the results of Section III. The same holds true for the share of productive workers in the total labour force. As Chinese managers have tended to shift redundant workers to the service branches of their enterprises the sign of the coefficient is expected although its low significance level precludes firm conclusions. Ownership differences in efficiency levels are insignificant which confirms to the impression gained all along this study that TVEs in the present sample are not very different from SOEs or COEs. However, the locational dummies show a significantly lower level of enterprise efficiency in Jilin province for the light industry aggregates. This result could be related to this province's inherited heavy industrial structure with little competitive pressures from a dynamic non-state sector which has been characteristic for the growth of light industry in other provinces.

V. CONCLUSION

This paper has followed one major aim. Enterprise level survey evidence from three interior provinces was analysed in order to test whether locational differences in economic performance that are apparent in provincial growth rates are confirmed at the microeconomic level. The results generally support this hypothesis. A direct comparison of the operating environment of SOEs in the interior provinces with results from an earlier survey of SOEs located along the coast revealed a significantly higher degree of administrative restrictions in the labour market in the interior sample although such differences were not present in other areas of decision making. The structural legacy of heavy industrial development under socialism was reflected by the large share of SOEs negatively affected by competition in their financial performance in the interior, whereas this was much less the case along the coast. Indeed, locational differences seemed to outweigh ownership differences in the determinants of enterprises' financial

performance, pointing at a combination of structural factors and more hesitant reform implementation by local governments in the interior as potentially major causes of divergent provincial growth performances.

The quantitative analysis of the present enterprise sample failed to find any significant efficiency improvements over the 1990-1994 period. Not only was the average rate of TFP growth negative for both SOEs and non-SOEs, but the former also displayed capital using and material saving technological change, in contradiction to factor scarcities at the national level. A likely culprit for this arguably unsustainable pattern of technical change is the unreformed nature of capital markets, granting SOEs access to loans at negative real interest rates while denying the rest of the economy much needed funds. The poor performance of TVEs in the present sample might be taken as further evidence that at least in regions where SOEs are dominant such problems will not simply wither away through the growth of the non-state sector. Reforms in the financial sector are urgently needed, both to improve capital allocation across enterprises and the efficiency of capital use within the SOE sector.

The significance of these findings for the ongoing debate over the success of Chinese enterprise reforms is that regional disparities in enterprise performance have to receive more attention than so far. Particularly as the 1990s have seen a growing income gap between the Southeastern coast and the interior provinces, more comparative analyses along the lines of this paper are needed to identify the exact interrelationship between structural conditions, reform mindedness by local governments and the resulting effectiveness of enterprise reforms. My hypothesis would be that there is a strong complementarity between a competitive market structure and the effectiveness of partial reform measures such as preferred by China's leaders so far. In the structural weaker interior provinces introducing selective performance incentives may not be sufficient to repeat the coastal success.

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